EPA United States Environmental Protection Agency

Benefits of Green Infrastructure

$170 million saved using green infrastructure compared with conventional deep tunnel construction in Cincinnati, Ohio

Green infrastructure can, in specific situations:

- ✓ **Reduce impact of severe storms**
- ✓ **Conserve water/reduce need to water**
- ✓ **Reduce water pollution from runoff and sewage overflows**
- ✓ **Conserve energy**
- ✓ **Save money**
- ✓ **Improve aesthetics and habitat**
- ✓ **Reduce heat island effects**
- ✓ **Recharge groundwater**

A well-designed green infrastructure landscape can have many cost-saving and environmental benefits, including the reduction of stormwater flow into sewer systems during heavy rains. Excessive stormwater flows into city sewer systems can cause water pollution.

Background: Green infrastructure can help contribute to community resiliency and reduce climate threats to critical infrastructure, water quality and human health. Heavy downpours are expected to become more frequent and intense in many parts of the U.S. as global temperatures continue to rise. Green infrastructure uses vegetation, soil and natural processes to manage water in place, reducing the impact of severe storms. Green infrastructure also provides additional benefits, including recharging groundwater, improving aesthetics, combating heat island effects and conserving energy. Treating water and wastewater requires a lot of energy. By reducing rainwater flows into sewer systems, green infrastructure can significantly reduce municipal energy use.

Combined sewer systems, as we have in many cities in the Midwest, release large amounts of sewage, mixed with stormwater, into surface water bodies, during and after heavy rain events. These combined sewer overflows (CSOs) are significant sources of pollutant loadings and a priority for Clean Water Act permitting and enforcement. EPA, working in partnership with state agencies, has pursued several enforcement actions requiring municipalities to implement measures to reduce CSOs.

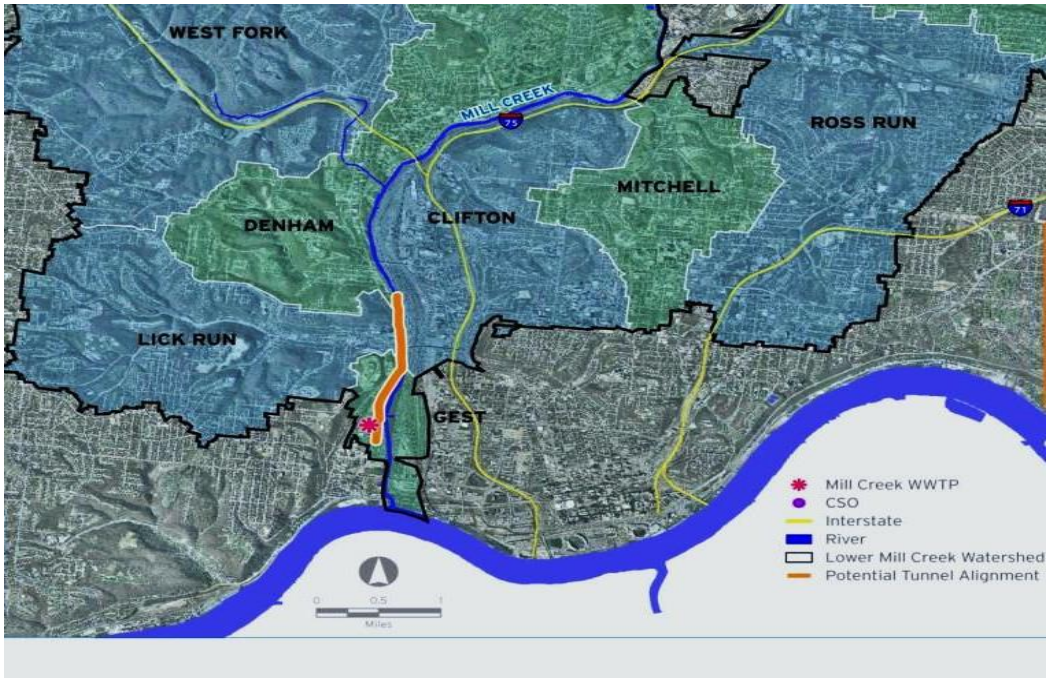
Cincinnati example: The Cincinnati regional sewer district operates the wastewater treatment plant and much of the sewer system. The area has combined sewers. As the city expanded and additional hard surfaces were built, stormwater runoff into the combined sewer system greatly increased the amount of water in the sewer system, exceeding the district's wastewater storage and treatment capacity. Consequently, Cincinnati was discharging very large quantities of polluted water from CSOs into several local waterways, which are tributaries to the Ohio River. The bacteria released to the local waterways was making the water unsafe for recreational activities such as swimming and wading, and caused violations of water quality standards.

Cincinnati

- Combined sewer overflows
- Water pollution
- Clean Water Act Violations
- Default Solution (Tunnel) for Lower Mill Creek area. "Lower Mill Creek Partial Remedy Study Report," Page 11
- **$414,400,000**
- Alternative Solution achieves same reduction of 1,780,000,000 gallons (in a typical year). "Lower Mill Creek Partial Remedy Study Report," Page 85
- **$244,367,000**

Net savings:

- **$170,033,000**



Lower Mill Creek Default Solution (Deep Tunnel Construction)

Under the terms of two consent decrees, the city, county and district were required to develop a plan to reduce the number of CSOs. For the Lower Mill Creek portion of the service area, the initial or default solution was a deep tunnel to temporarily store rainwater and sewage during rain events. After a rain event, the district would pump the combined sewage to the wastewater treatment plant for treatment. This default solution was estimated to cost $414.4 million (2006 dollars).

As a follow-up to the initial CSO control plan for the Lower Mill Creek sewer service area, the county, city and district considered alternative solutions. One alternative plan included green infrastructure components and other source control measures, which would reduce stormwater draining into the sewer system. By keeping the stormwater out of the sewer system, and more effectively utilizing storage capacity in the existing sewers, the district would be able to reduce CSOs without constructing the deep tunnel. This alternative solution was estimated to cost $244.367 million (2006 dollars) – a significant cost savings compared to the conventional solution. Additional Pollution Prevention benefits include conservation of materials, energy and carbon dioxide emissions associated with construction. The alternative solution included, as a key element, a green corridor, which would convey flows above ground and have a wide floodway to hold water in severe storms and help prevent flooding. The green corridor would also include walking paths and other amenities for the neighborhood, providing value back to the community in terms of livability and the potential for economic revitalization.

EPA and the state worked closely with local officials during development of the alternative plan, and the more sustainable solution was approved in 2013. The county, the city and the sewer district are now implementing the alternative "green" solution, which will save an estimated $170.033 million compared to the conventional solution (the deep tunnel). The alternative solution, which allows water to move above ground, avoids significant amounts of pumping and treating of combined sewage, resulting in reduced energy use and substantial climate change-related benefits. In addition, the aesthetics of the area will be improved, and it is expected that neighborhood stabilization and economic revitalization benefits will be realized. Additional information and contacts for this project are available at http://projectgroundwork.org/projects/lowermillcreek/.